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(54) Method for making semiliquid cast aluminium alloys.

(57) The method comprises the steps of bringing the aluminium alloy to a liquid status at a temperature of about 700°C in a melting oven,generating a laminar flow of fused aluminium alloy and conveying it onto a tiltable surface so as to adjust the alloy flow falling rate,cooling this surface by refrigerating media circulating therein,collecting the semiliquid aluminium alloy in vessels and cooling the alloy.

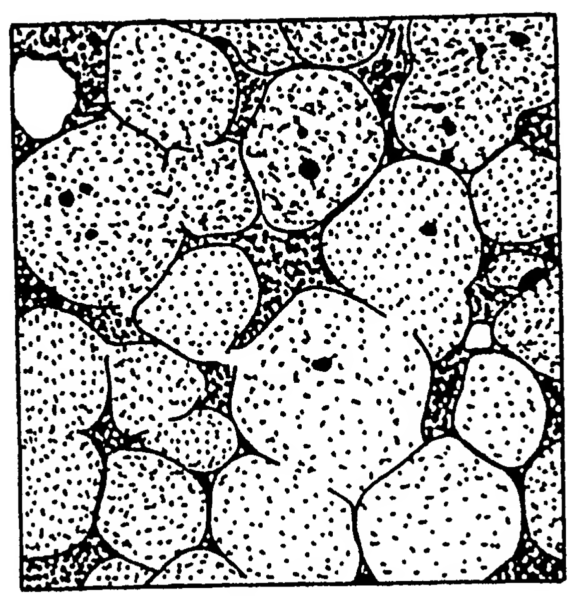

Fig. 1

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BACKGROUND OF THE INVENTION

The present invention relates to a method for making semiliquid aluminium alloys and a system for carrying out the method.

As is known,aluminium based component making industries usually use aluminium and aluminium alloys either in the solid or in the liquid status.

From a practical standpoint,it would be desirable to use semiliquid aluminium alloys :however it is not presently possible to use semiliquid aluminium alloys obtained by conventional solidifying methods.

In fact the structure of these alloys,which consists of a plurality of interlaced dendrites,as is shown in figure 2,prevents these alloys from properly flowing,with low solid phase amounts,of the order of 20%.

According to experiments carried out by the Applicant it has been found that if the aluminium alloy is held under a strong stirring during its solidifying process,then it is possible to provide a solid phase having a globular or spheroidal structure.

Based on this studies,efforts have been already made to provide methods adapted to prevent dendrites from forming during the liquid aluminium alloy solidifying process.

For example mechanical stirrers have been already tested which,however,have not been found to be satisfactory because of a lacking of shearing stresses and a quick wear of the stirring metal elements included in these stirrers.

Yet other approaches provided for the use of electromagnetic stirrers or static mixers in which the aluminium alloy is compelled to move through a tortuous path.

However,in these cases too,the problem is to be solved of the wearing of the mixing apparatus forming materials and blocking of the mixer because of aluminium slag particles.

SUMMARY OF THE INVENTION

Accordingly,the present invention sets out to overcome the above mentioned drawbacks,by providing a method which is specifically adapted to make globular structure semiliquid cast aluminium alloys which method is devoid of any wear effect on the apparatus for carrying out the method itself.

Within the scope of the above aim,a main object of the present invention is to provide such a properly controlling high shearing stresses on the semiliquid aluminium alloys,so as to precisely control the forming characteristics thereof.

Another object of the present invention is to provide such a method which affords the possibility of accurately controlling the aluminium alloy cooling step,without contaminating the aluminium alloy or generating dangerous aluminium sprays.

Yet another object of the present invention is to provide such a method which can be carried out,in a very reliable and safe way,by a very simple system.

According to one aspect of the present invention, the above aim and objects,as well as yet other objects, which will become more apparent hereinafter,are achieved by a method for making semiliquid cast aluminium alloys characterized in that said method comprises the steps of bringing an aluminium alloy to a liquid status at a temperature of about 700 °C in a melting oven, generating a fused aluminium laminar flow by conveying fused aluminium onto a tiltable plate,adjusting said tiltable plate slope so as to adjust said alloy flow falling rate,cooling said plate by refrigerating media circulating through a gap,collecting in vessels said semiliquid aluminium alloy from said tiltable plate and cooling said aluminium alloy.

BRIEF DESCRIPTION OF THE DRAWINGS

Further characteristics and advantages of the present invention will become more apparent from the following detailed description of a preferred embodiment thereof,which is illustrated,by way of an indicative but not limitative example,in the figures of the accompanying drawings,where:

figure 1 is a schematic view illustrating the globular or spheroidal metallurgical structure obtained upon a partial solidifying of the aluminium alloy;

figure 2 is another schematic view showing an aluminium alloy made by a conventional solidifying method,and clearly illustrating the interlaced dendrites thereof;

figure 3 shows a diagram representing the shear stress varying depending on the slop ; and

figure 4 shows a schematic diagram of a possible system for making the aluminium alloys by the method according to the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

With reference to the figures of the accompanying drawings,the method according to the present invention comprises the steps of introducing the aluminium alloy into a melting oven,for example a swinging oven or a pressurized oven,and bringing said aluminium alloy to a liquid status at a temperature of about 700° C.

With the aluminium alloy in the liquid status,the metal held in the oven,schematically indicated at 1 in figure 4,is conveyed,through a suitable flow distributor,onto a broad metal surface or plate 2 which can be either of flat or curved configuration and the main feature of which is that it is so slanted as to downwardly convey the aluminium alloy.

The plate 2,or surface,is provided with a surface coating 3 made of a ceramics material,e.g. alumina or silicon carbide or zirconia or other suitable materials having comparable wear resistance characteristics.

Inside the mentioned plate 2 there is formed a gap 4 therethrough refrigerating media are caused to circulate which operate to cool,in a controlled and accurate way,said plate in order to reduce the temperature thereof.

In this connection it should be pointed out that the refrigerating medium is circulated through said gap 4 without contaminating the semiliquid aluminium alloy and without originating dangerous aluminium sprays.

The provision of a broad slanted plate affords the possibility both of holding under stirring the fused mass conveyed on this plate and removing the solidifying heat :thus a semiliquid aluminium alloy will be made having an actually globular or spheroidal structure.

This method,moreover,owing to the generated shear stresses favours a fracturing of the dendrite fragments,because of the repeated strong mechanical impacts.

Thus,a globular metallurgic structure will be obtained and the aluminium alloy will have advantageous properties.

The control of the process and of the proper stirring of the aluminium alloy is carried out by changing the slope angle of the plate or surface thereon the aluminium alloy is caused to flow,so as to provide a corresponding variation of the aluminium alloy falling rate.

Moreover a proper control of the process temperature affords the possibility of holding the thermal parameters within an optimum range for the intended purpose.

To the foregoing it is to be added that,as shown in figure 3,it is further possible,by properly adjusting the slope of the plate,to generate the desired shear stress.

The aluminium alloy delivered from the mentioned tiltable plate or surface is then collected,in a semiliquid status,in suitable collecting vessels therein it is then cooled down.

Thus,the cooled aluminium alloy can be used for forming component parts by conventional moulding and die casting methods.

In particular from the use of aluminium alloys made by the inventive method,a further advantage will be obtained,that is that of a less air trapping because of a high viscosity of semiliquid aluminium,together with a complete lacking of porosity and very small solidifying contractions.

A great waste reduction is moreover obtained, together with a very small wear of the molds of the die casting system machines,which can be used at working temperature of at least 100° C less than conventional die casting temperatures.

A power saving is further obtained since the melting ovens can be held in a rest condition at lower temperatures than conventional melting temperatures.

A further advantage of the method according to the present invention is that it further affords the possibility of easily making very complex shape parts.

Moreover,it is possible to use reduced power pressing machines operating by a single pressing stage.

Possible processing waste,moreover,can be easily recycled with the possibility of easily using second-melting alloys.

Thus,the method according to the present invention provides a high production yield,since it is possible to greatly reduce the number of the used molds,with a less wear thereof.

From the above disclosure it should be apparent that the invention fully achieves the intended aim and objects.

While the invention has been disclosed and illustrated with reference to a preferred embodiment thereof,it should be apparent that the disclosed embodiment is susceptible to several modifications and variations,all of which will come within the scope and spirit of the appended claims.

Claims

1- A method for making semiliquid cast aluminium alloys,characterized in that said method comprises the steps of bringing an aluminium alloy to a liquid status at a temperature of about 700° C in a melting oven,generating a fused aluminium laminar flow by conveying fused aluminium onto a tiltable plate, adjusting said tiltable plate slope so as to

correspondingly adjust said alloy flow falling rate,cooling said plate by a r frigerating medium circulating through a gap in said plate,collecting in vessels said semiliquid aluminium alloy from said plate and cooling said aluminium alloy.

2- A method according to claim 1,characterized in that said method comprises the steps of bringing said aluminium alloy to a temperature of about 700°C in a melting oven,generating a fused aluminium alloy laminar flow,by conveying said aluminium alloy onto a slanted plate,adjusting said plate slope so as to correspondingly adjust said alloy flow falling rate, cooling said plate by a refrigerating fluid medium held at a controlled temperature,said fluid medium being caused to flow through a gap defined under a bottom face of said plate,collecting in collecting vessels said semiliquid aluminium alloy from said plate and cooling said aluminium alloy so as to form and hold therein a globular alloy structure.

3- A method according to claim 1,characterized in that said method further comprises the step of fracturing said alloy so as to prevent dendrites from forming therein during said cooling step.

4- A method according to claim 1,characterized in that said method further comprises the step of subjecting said semiliquid aluminium alloy to a strong stirring.

5- A method according to claim 1,characterized in that said method further comprises the step of subjecting said semiliquid aluminium alloy to shear stresses by tilting said plate so as to modify the structure of said dendrites particles to cause said dendrites to assume a globular structure.

6- A method according to claim 1,wherein said gap does not directly contact said semiliquid aluminium alloy.

7- A system for making semiliquid aluminium alloys by a method according to claim 1,characterized in that said system comprises a melting oven including a fused aluminium flow distributor and a slanted metal plate adapted to operate as a heat exchanger,said plate being coated by a ceramics material.

8- A system according to claim 7,characterized in that said ceramics material consists of a ceramics material selected from alumina,silicon carbide,zirconia or other like materials having a high abrasion resistance.

9- A system according to claim 7,characterized in that said plate has a flat configuration.

10- A system according to claim 7,characterized in that said plate has a curved configuration.

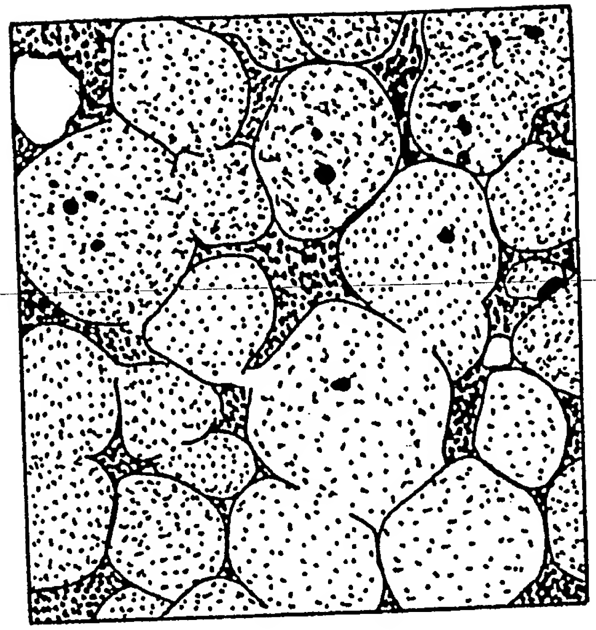

Fig. 1

Fig. 2

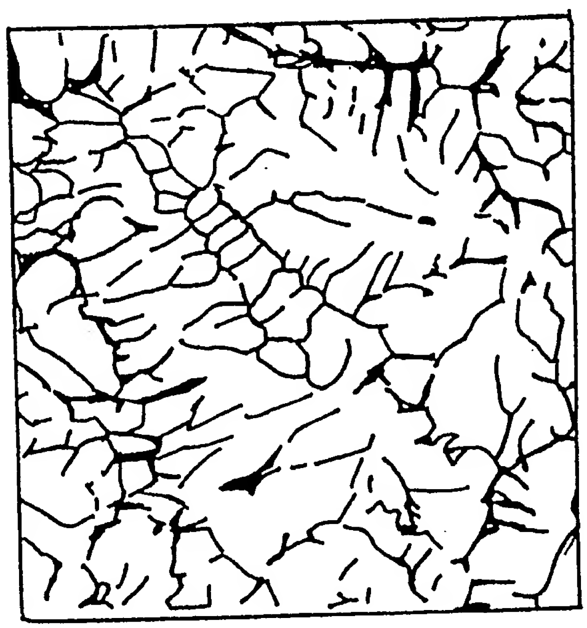

Fig. 3

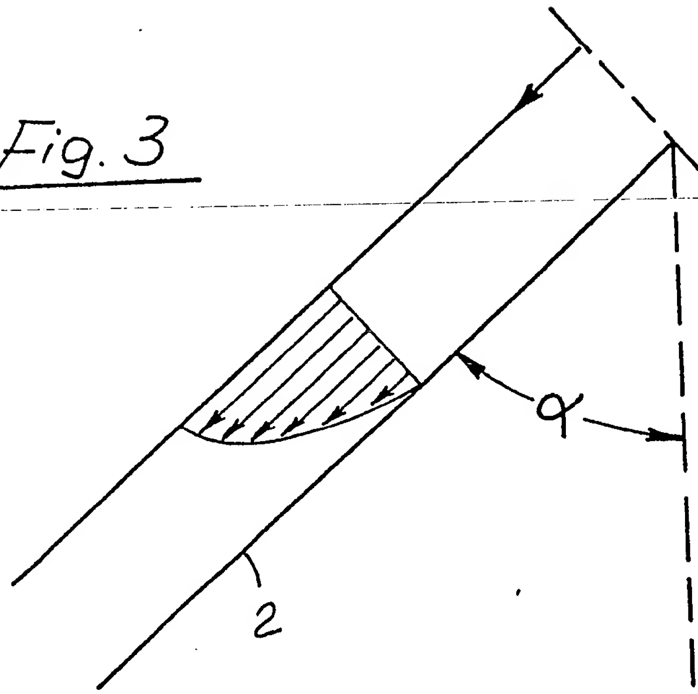

Fig. 4